

THE CIRCULATION OF THE ATMOSPHERE.

Mémoires originaux sur la Circulation générale de l'Atmosphère. Annotés et Commentés par Marcel Brillouin, Maître de Conférences à l'École Normale Supérieure. Pp. xx+163. (Paris: Georges Carré et C. Naud, 1900.)

THIS may be described as a French Student's note-book of foreign memoirs upon the general circulation of the atmosphere. It contains papers upon the subject, partly translated in full, partly in extract or analysis, by Halley, Hadley, Maury, Ferrel, James Thomson, W. von Siemens, Möller, Oberbeck and von Helmholtz, with a short introduction and some critical notes to the current text.

The book may be welcomed as calling attention to a subject which greatly needs attention in this country. But little has been done for it since James Thomson, in the Bakerian lecture of 1892, revived the ideas he had originally put forward at the meeting of the British Association at Dublin in 1857. In the United States Prof. Cleveland Abbe has collected and translated the principal memoirs, but the mathematical treatment of atmospheric circulation has been neglected in England.

Contrary to the general experience of scientific books in French, the work is rather dull. The introduction makes it clear that only foreign memoirs are included, and the work of MM. Tastes and Duclaux, as well as that of M. Teisserenc de Bort and of M. Brillouin himself, particularly "Vents contigus et nuages" (*Ann. du Bur. Centr. Mët.* 1898) is only incidentally referred to, but this does not altogether account for the impression. The subject itself is difficult; indeed, in its details it is far beyond the power of mathematics. No one can suppose that it is possible to deduce the actual motion of the air at this instant at every part of the globe from its primary causes, namely the insolation of one half the globe, the radiation from the other half, the force of gravity and the rotation of the earth; and yet that is what, in a generalised manner, most of the authors quoted set out to do. Of course, a conventional atmosphere has to be used and a conventional circulation therein accounted for; and, as a matter of fact, the assumptions and conventions that a writer makes in order to bring his powers of calculation to bear are more interesting than the details of elaborate mathematics on artificial hypotheses leading to results which, to put the matter bluntly, are only true in so far as they are not new.

Von Siemens' application of the principles of conservation of momentum and of energy strikes a livelier key, but it is only when von Helmholtz's papers are reached that the reader can feel that the analysis has really become an engine of research. The mode of treatment becomes quite different. The hydrodynamics and thermodynamics of real air are the starting point, and equatorial heating becomes a secondary consideration. As each section is developed, and the dynamical effect of the scale of the problem, the equilibrium shapes of atmospheric layers, the wave phenomena that can occur between layers of different density are unfolded, it becomes possible to be enthusiastic as to the service that mathematics can render to this subject.

Von Helmholtz himself gives no general system of

atmospheric circulation, but M. Brillouin indicates the results in that direction that flow from his conclusions. He finds them in general agreement with Ferrel's distribution, and pays a tribute to Ferrel's achievement on that account.

The notes throughout are frank, appropriate and useful. It is to be feared that the book appeals to a limited class of readers, namely those who are at the same time meteorologists and mathematicians. The ordinary meteorologist will feel the want of a mathematical introduction, and the ordinary mathematician of a meteorological introduction.

W. N. S.

OUR BOOK SHELF.

The Elements of the Differential and Integral Calculus.

By J. W. A. Young, Assistant Professor of Mathematical Pedagogy in the University of Chicago, and C. E. Linebarger, Instructor in Chemistry and Physics in the Lake View High School, Chicago. Pp. xvii + 410. (London: Hirschfeld Bros., 1900.) Price 10s. 6d. net.

Differential and Integral Calculus with Applications for Colleges, Universities, and Technical Schools. By E. W. Nichols, Professor of Mathematics in the Virginia Military Institute. Pp. xi + 394. (Boston U.S.A.: D. C. Heath and Co., 1900.)

THE first of these books is based upon the German treatise on the differential and integral calculus with special reference to chemistry which was published by Profs. Nernst and Schönflies five or six years ago. The chief alteration in the mode of presenting the subject is that the method of limits is used throughout in the treatise before us to the exclusion of the method of differentials which was early introduced and much employed in the German text-book. But the distinctive feature of the original work, viz. the continual use of illustrative examples from chemical and physical science, has been retained in the adaptation before us, and many additional examples of the like kind have been introduced.

The treatise in its present shape forms a very convenient and serviceable text-book for English and American students of chemistry desirous of obtaining an elementary acquaintance with the principles and methods of the calculus, for here they will find a very clear presentation of the fundamental ideas of the subject, and in particular will be furnished with abundant easy exercises and applications of the mathematical processes to subjects in which they are specially interested. The book is well designed to save the time and keep up the interest of such students. Thus the first chapter contains an introduction to analytic geometry, with numerous exercises on the graphing of curves, and the last chapter is a characteristic one on the differentiation and integration of functions found empirically.

Whilst so much has been done to smooth the path and provide for the wants of the class of students specially in view, it seems matter for regret that an additional chapter on the solution of easy linear differential equations has not been furnished.

We have in Prof. Nichols' work another elementary text-book specially designed as a first book on the calculus for students of physics and engineering. It is a clear and teachable work for beginners, and contains several easy applications to mechanics and electricity. The ordinary applications of the differential calculus to geometry are brought forward earlier than usual; thus we have a chapter on tangents, normals and asymptotes to plane curves before the chapters on successive differentiation, series, illusory forms and maxima and minima. Then, after a chapter on partial and total differentiation,

we have applications to curvature, envelopes, singular points and tracing of curves.

The second part of the book contains the fundamental methods of the integral calculus, including a slight treatment of double and triple integrals and their applications to surfaces and volumes.

There is also a short chapter on differential equations, giving the methods of dealing with some of the simpler forms, and the concluding chapter contains applications to such subjects as moments of inertia and the deflection of beams.

Compared with recent English treatises on the calculus for engineering and physical students, the work before us appears slight and superficial in its technical applications. But as an elementary text-book on pure mathematics it has decided merit, and is evidently the production of an experienced teacher.

Album de Aves Amazonicas. Organizado pelo Dr. Emilio A. Goeldi, Director do Museu Paraense. (Museu Paraense de Historia Natural e Ethnographia, 1900.)

THE illustrated supplement to Dr. Goeldi's "Aves do Brazil," of which the first part, consisting of twelve coloured plates designed by Señor Ernesto Lohse, has been issued, will when completed give a good general idea of the avifauna of those regions. The birds represented in the present fasciculus comprise the cormorants, grebes, gulls, terns, waders, plovers, herons, egrets, boatbill, storks, spoonbills, rails, geese, ducks, toucans and kingfishers, as well as those two curious forms, the hoactzin and the sun-bittern. In herons and their allies the country is very rich, and two plates illustrate ten species of toucan, both sexes in this, as well as in other cases, being figured when desirable. Several species are figured on most of the plates, and they number eighty in all. But one plate is entirely devoted to a beautiful illustration (produced from an instantaneous photograph taken in 1900) of a breeding-place of the scarlet ibis. The crowd of graceful scarlet birds, backed by the rich, deep greenery of the western tropics, must afford a sight worth going to South America to see. There are pleasing bits of tropical scenery in the background of the plates, which form quite pretty pictures. The work has been printed at Zürich, and although the designs are on a rather small scale, and too much must not be expected of colour-printing, the illustrations of the birds strike us as being decidedly good, and we readily recognise at a glance several old South American acquaintances. The supplement will be most useful to any one travelling in the country who takes even a passing interest in natural history. The plates, like Dr. Goeldi's recently completed "Aves do Brazil," may be regarded as decidedly popular, and on that account will doubtless prove the more generally useful.

Qualitative Chemical Analysis, Organic and Inorganic. By F. Mollwo Perkin, Ph.D. Pp. viii + 266. (London: Longmans, Green and Co., 1901.)

THIS book begins with a general account of dry reactions and reactions in solution, attention being paid both to the manipulative and the theoretical aspects. Then follows the usual account of metals in groups with their tests, and afterwards come the acids. The remaining third of the book is devoted to what is called organic analysis, and here appears the most distinctive feature, namely, a list of tests for a great variety of organic substances—acids, alcohols, sugars, nitrogenous bases, glucosides and alkaloids. The intention of the author, as declared in the preface, has been "to write a book in which theory and practice are more or less dovetailed." It is difficult to find any realisation of this in the large section devoted to organic substances, but the treatment of the inorganic section is more in accordance with the stated object.

A. S.

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LETTERS TO THE EDITOR.

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The Fire Walk Ceremony in Tahiti.

THE very remarkable description of the "Fire Walk" collected by Mr. Andrew Lang and others had aroused a curiosity in me to witness the original ceremony, which I have lately been able to gratify in a visit to Tahiti.

Among these notable accounts is one by Colonel Gudgeon, British Resident at Raratonga, describing the experiment by a man from Raiatea, and also a like account of the Fiji fire ceremony from Dr. T. M. Hocken, whose article is also quoted in Mr. Lang's paper on the "Fire Walk," in the *Proceedings* of the Society for Psychical Research, February, 1900. This extraordinary rite is also described by Mr. Fraser in the "Golden Bough," and by others.

I had heard that it was performed in Tahiti in 1897, and several persons there assured me of their having seen it, and one of them of his having walked through the fire himself under the guidance of the priest, Papa-Ita, who is said to be one of the last remnants of a certain order of the priesthood of Raiatea, and who had also performed the rite at the island of Hawaii some time in the present year, of which circumstantial newspaper accounts were given, agreeing in all essential particulars with those in the accounts already cited. According to these, a pit was dug in which large stones were heated *red hot* by a fire which had been burning many hours. The upper stones were pushed away just before the ceremony, so as to leave the lower stones to tread upon, and over these, "glowing red hot" (according to the newspaper accounts), Papa-Ita had walked with naked feet, exciting such enthusiasm that he was treated with great consideration by the whites, and by the natives as a God. I found it commonly believed in Tahiti that anyone who chose to walk after him, European or native, could do so in safety, secure in the magic which he exercises, if his instructions were exactly followed. Here in Tahiti, where he had "walked" four years before, it was generally believed among the natives, and even among the Europeans present who had seen the ceremony, that if anyone turned around to look back he immediately was burned, and I was told that all those who followed him through the fire were expected not to turn until they had reached the other side in safety, when he again entered the fire and led them back by the path by which he had come. I was further told by several who had tried it that the heat was not felt upon the feet, and that when shoes were worn the soles were not burned (for those who followed the priest's directions), but it was added by all that much heat was felt about the head.

Such absolutely extraordinary accounts of the performance had been given to me by respectable eyewitnesses and sharers in the trial, confirming those given in Hawaii, and, in the main, the cases cited by Mr. Lang, that I could not doubt that if all these were verified by my own observation, it would mean nothing less to me than a departure from the customary order of Nature, and something very well worth seeing indeed.

I was glad, therefore, to meet personally the priest, Papa-Ita. He is the finest looking native that I have seen; tall, dignified in bearing, with unusually intelligent features. I learned from him that he would perform the ceremony on Wednesday, July 17, the day before the sailing of our ship. I was ready to provide the cost of the fire, if he could not obtain it otherwise, but this proved to be unnecessary.

Papa-Ita himself spoke no English, and I conversed with him briefly through an interpreter. He said that he walked over the hot stones without danger by virtue of spells which he was able to utter and by the aid of a goddess (or devil as my interpreter had it), who was formerly a native of the islands. The spells, he said, were something which he could teach another. I was told by others that there was a still older priest in the Island of Raiatea, whose disciple he was, although he had pupils of his own, and that he could "send his spirit" to Raiatea to secure the permission of his senior priest if necessary.

In answer to my inquiry as to what preparations he was going to make for the rite in the two or three days before it, he said he was going to pass them in prayer.